ATTACHMENT 5

NOTEGRAM

Date: October 4, 1995

To: T.J. Meyer

From: D.E. Burns

Subject: PCB CONCENTRATION ESTIMATES FOR THE PBF-25 LEACH FIELD

The estimated PCB concentrations in the PBF-25 leach field soil are 19 mg/kg for a 5,000,000 gallon release of septic system water, and 150 mg/kg for a 40,000,000 gallon release. The following paragraphs discuss how these numbers were calculated.

Both soil concentration estimates were derived using two assumptions. First, the water released from the PBF-25 septic system was assumed to have infiltrated into a circle of soil with a 10.5 ft (3.2 m) diameter and a 3 ft (0.9 m) thickness. Using these two dimensions, the volume of soil in the leach field was calculated to be 260 ft^3 (7.36 m^3) (volume = $\pi d^2 t/4$ = [3.14 x [10.5 ft]^2 x 3 ft] / 4 = 260 ft^3). Second, the concentration of PCBs in the septic system water was assumed to be 11 μg/L. This liquid concentration is equal to the measured concentration in the PBF-25 septic tank.

With these two assumptions, the following equation was used to estimate the leach field contaminant concentrations;

$$C_{soil} = C_{water} \times V_{water} \times CF$$

where;

C_{soil} = Contaminant soil concentration (mg/kg)

C_{water} = Contaminant water concentration (μg/L)

V_{water} = Volume of water released (L) (= 1.9E+07 L [5E+06 gal] or 1.5E+08 L [4E+07 gal])

CF = Conversion factor given by;

$$CF = \frac{0.001\ mg/\mu g}{7.36\ m^3 \times (100\ cm/m)^3 \times 1.5\ g/cm^3 \times 0.001\ kg/g}$$

If you have any questions about these calculations, please call me at 6-4324.

PBF-10

Lockheed
Idaho Technologies Company

INTERDEPARTMENTAL COMMUNICATION

Date: July 27, 1995

To: PBF-10 Project Files

From: Chris M. Hiaring, MS 3953 CH

Subject: POWER BURST FACILITY (PBF)-10 SITE RECLAMATION PROJECT - CMH-01-95

Introduction

The PBF Evaporation Pond was used from 1972 to 1984. The pond, 140 ft long, 140 ft wide, and 4.5 ft deep, was lined with a 30 mil Hypalon liner. Water containing chromium-based algae and corrosion inhibitors from the PBF reactor's secondary coolant system was discharged into the evaporation pond via the corrosive waste sump. Additionally, discharges associated with the regeneration of demineralizers were also sent to the pond. The water was treated by bubbling sulfur dioxide through it to reduce the hexavalent chromium to less toxic trivalent chromium. In 1984 a phosphate based corrosion inhibitor replaced the chromium-based inhibitor, thereby eliminating further discharge of chromium into the waste stream.

A remedial action was completed in August 1994. This consisted of gridding and sampling the evaporation pond area and the excavation of 170 cubic yards of sediment from the pond. Areas that exhibited concentrations of chromium greater than 800 mg/kg and/or cesium-137 greater than 30 pCi/g were removed using shovels and a skid-steer front-end loader. These were placed into low-level waste containers and disposed of at the Radioactive Waste Management Complex.

Verification sampling was performed in the remaining grids and under the liner to assure the remaining concentrations of chromium and cesium-137 were below the cleanup levels. There was 6 to 12 inches of sediment remaining on top of the pond liner. Existing levels of chromium in the pond sediments were below toxicity characterization leaching procedure levels.

Background

The scope of this Site Reclamation activity included: a) initial radiological survey of evaporation pond area; b) removal of the chain-link fence and transporting fence to be excessed; c) removal of fence posts and concrete and transportation to the Central Facilities Area (CFA) landfill; d) removing sediment from Hypalon liner, survey liner for radiological hazards, section and remove liner from pond and transport liner to the CFA Bulky Waste Landfill; e) pushing the sides of the berm into the pond making the pond level with the surrounding area and f) planting native grasses on the disturbed area.

Field Activities

After several delays because of wet weather, the field activities began in May 1995, with Radiological Control Technicians (RCTs) performing a radiological survey. At that time RCTs found no radiological contamination above background levels.

After several more delays because of wet weather, the site reclamation crew was able to begin work on June 5, 1995. The activities began with a site briefing meeting, after which the area was roped off and posted with construction signs. All required procedures were followed each day of work. The weather caused three work stoppages during the two week field activity.

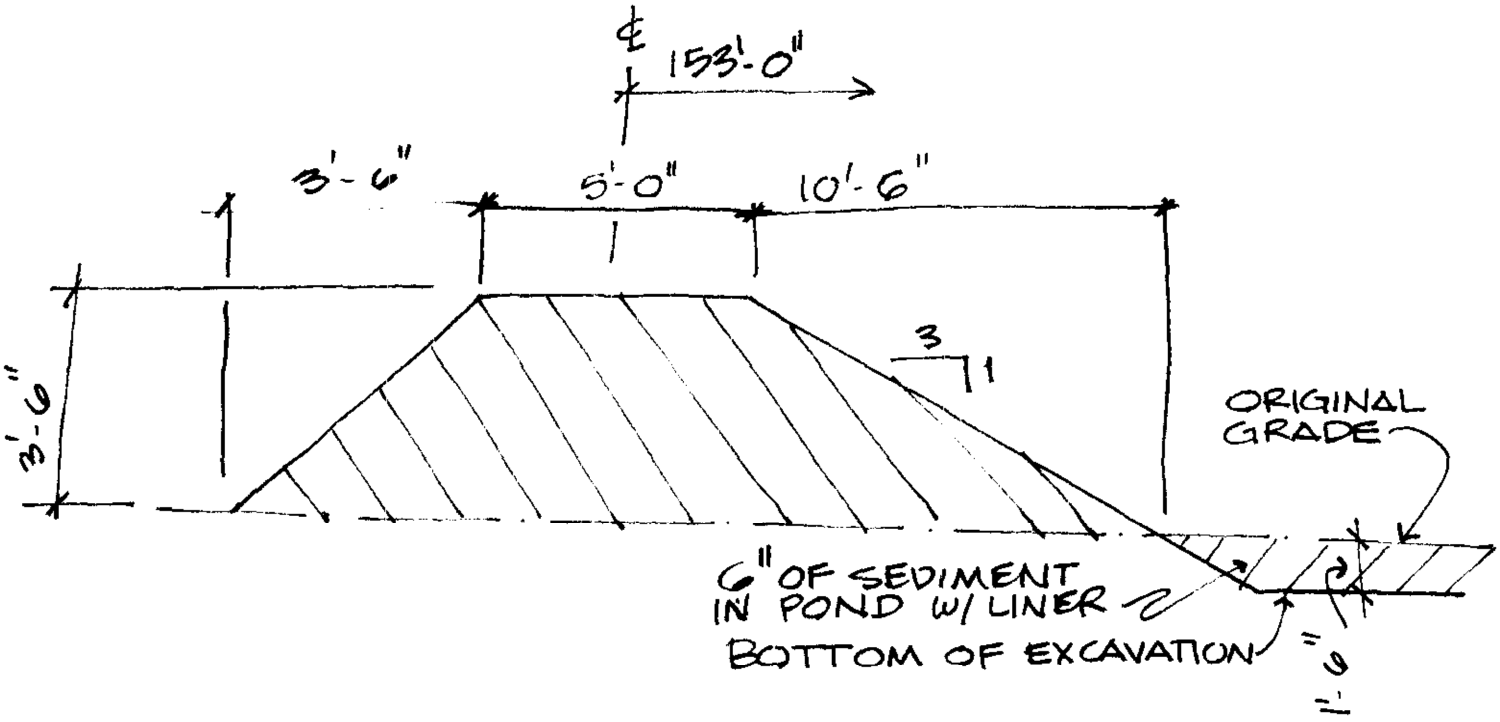
The chain-link fence was removed, surveyed and is being processed as excesses material. The posts and concrete were sized and transported to CFA Bulky Waste Landfill. The sediment on the liner was partially removed, but the Hypalon liner was brittle and began ripping. At that time the equipment operators used a front-end loader to pick up the liner (this caused some soil to be transported with the liner), the RCTs surveyed the liner sections with its associated soil and it was transported to the CFA Bulky landfill. A total of 65 cubic yards of liner and 15 cubic yards of debris were disposed of at the CFA landfill.

The berm was pushed into the pond area and rough graded. Because of moisture that was trapped in a soil/clay layer above the basalt bedrock, the heavy equipment sank and made large ruts in several spots. This delayed the final grading until this moisture layer dried. On July 20, 1995, the final grading was completed and has been inspected. The PBF-10 Site Reclamation Project is completed, except for seeding of native grasses. Final seeding using the Hydroseeder, will occur in late September 1995, when fall and winter moisture will more effectively germinate the seeds.

Summary

The scope of this project has been successfully completed and is returning an area of the Idaho National Engineering Laboratory back to its original condition. The scope was completed in a safe and effective manner using the Decontamination and Decommissioning dedicated crew.

cc: T. J. Meyer, LITCO, MS 3953
Steve W. Forcey, LITCO, MS 3595
R. Doug Greenwell, LITCO, MS 3953
Alan T. Jines, DOE-ID, MS 1117
EO ARDC Files, MS 3922
Chris M. Hiaring Letter File



CROSS SECTIONAL AREA OF BERM

$$\frac{5' + 19'}{2} \times 3.5' = 42 \text{ □}$$

PERIMETER OF BERM

$153' \times 4 = 612$ LIN. FT.

VOLUME OF BERM

$42 \text{ □} \times 612 \text{ l.f.} = 25{,}704 \text{ FT}^3$

$= 952 \text{ yd}^3$

EXCAVATION VOLUME OF POND

$$\frac{140 \times 140 \times 1.5}{27} = 1{,}089 \text{ yd}^3$$

Project File Number

EDF Serial Number	ER-WAG5-106
Functional File Number	INEEL/INT-98-00382

ENGINEERING DESIGN FILE

Project/Task	WAG 5 Comprehensive RI/FS Operable Unit 5-12			
Subtask	Track 1 assessment for ARA-16	EDF Page	1	of 31

TITLE: Track 1 Assessment for the ARA-16 Radionuclide Tank Behind ARA-I

SUMMARY:

Site ARA-16 is the location of a 1,000-gal underground storage tank located behind the Auxiliary Reactor Area (ARA)–I. The site was designated for Track 1 evaluation in the 1991 Federal Facility Agreement and Consent Order negotiated by the Department of Energy, the Environmental Protection Agency, and the Idaho Department of Health and Welfare.

A draft Track 1 Decision Documentation Package addressing ARA-16 was prepared in 1993 but was never completed. The residual contents of the tank contain mixed waste with transuranic concentrations. The complete evaluation of the Track 1 site was deferred to the Waste Area Group (WAG) 5 comprehensive remedial investigation/feasibility study (RI/FS) to explore options for disposing of the tank contents and removing the tank and its associated underground pipes. Risk associated with potential soil contamination originating with the tank is evaluated in the baseline risk assessment (BRA) component of the RI/FS. Estimates are based on soil samples collected under the WAG 5 work plan sampling program (INEL 1996).

This engineering design file contains the 1993 decision documentation package that was prepared for ARA-16 to preserve the site research included in the draft Track 1 report and supply a document that can be cited. Further evaluation of the site based on analytical results is presented in the WAG 5 comprehensive RI/FS report.

Distribution (complete package): F. L. Webber, MS-3953
C. M. Hiaring, MS-3953
WAG 5 project file

Distribution (summary page only):

Author/Department	Date	Reviewed	Date	Approved	Date
K. J. Holdren	April 10, 1998	C. M. Hiaring	April 14, 1998	F. L. Webber	April 14, 1998
K J Holdren Dept. 4160		LMITCO Review Chris Hiaring	Date	LMITCO Approval Frank L. Webber	Date

DECISION DOCUMENTATION PACKAGE
COVER SHEET

PREPARED IN ACCORDANCE WITH

TRACK 1 SITES:
GUIDANCE FOR ASSESSING
LOW PROBABILITY HAZARD SITES
AT INEL

SITE DESCRIPTION: RADIONUCLIDE LIQUID WASTE UNDERGROUND STORAGE TANK ARA-729 BEHIND ARA-I

SITE ID: ARA-16 OPERABLE UNIT: 5-01

WASTE AREA GROUP: 5 DOCUMENT DATE: APRIL 28, 1993

I. SUMMARY - PHYSICAL DESCRIPTION OF THE SITE:

Auxilary Reactor Area (ARA)-16 is the site of a 1,000-gal stainless-steel underground storage tank (ARA-729) located behind ARA-I. The tank was built in 1959 and taken out of service in 1988 when ARA-I was shut down. The tank was emptied and all pipes and connections to the tank were removed and capped. The tank is bedded in an 8-in.-thick unlidded concrete containment vault. Within the vault, the tank is nested in gravel. About 3.5 ft of mixed soil and gravel cover the tank and vault. The tank area is 30 × 30 ft and is surrounded by a barbed-wire, chain-link fence that is 7 ft tall and gated.

ARA-16 was the recipient of liquid radioactive wastes from two processes, the hot cells operations in building ARA-626 and materials research and testing in ARA-627. Records indicate that the hot cells were in operation from 1957 to 1988, and that the tank was installed in 1959. It is unclear how wastes were disposed before the tank was installed. Wash water was routed to the tank from the hot cells from 1959 until the facility was shut down in 1988. Materials research and testing were supported at ARA-I from 1970 to 1984, resulting in the disposal of radioactive metal etching fluids to ARA-16.

Wastes were routed to the tank via 4-in. stainless-steel pipes. The tank was equipped with a high-liquid-level detector. When required, tank contents were pumped into a tank truck and shipped to ICPP.

I. SUMMARY - PHYSICAL DESCRIPTION OF THE SITE:

The tank was deactivated in 1988 when ARA-I was officially shut down. Shutdown tasks for ARA-16 included emptying the tank, excavating partially, removing and capping all lines, performing field surveys, collecting laboratory samples, and backfilling over the area when procedures were complete. Most of the tank contents were removed; about 109 L of sludge remain. Field radiation surveys performed during the 1988 shutdown activites indicated the presence of general contamination in the subsurface soils over the tank ranging from 400 to 1,000 disintegrations per minute. Activity less than or equal to 3,000 counts per minute was detected in soils near the two inlet lines in the manhole cover; activity less than or equal to 5,000 counts per minute was detected in soils near the outlet pump housing. Organics, inorganics, and radionuclides were targeted for analysis and were detected in tank content samples.

The tank is in the midst of the radioactive contaminated soil area associated with the Special Low Power Reactor (SL)-1 accident and clean up. Radiation hazard signs are posted on all four sides of the fence around the tank. The only currently visible evidence of the tank, in addition to signs posted on the fence, is a piece of 2 inch angle iron protruding from the ground at the center of the fenced enclosure. When ARA-I was shut down in 1988, the angle iron was left in place as an future excavation guide.

DECISION RECOMMENDATION

II. SUMMARY - QUALITATIVE ASSESSMENT OF RISK:

Risk-based calculations have not been generated for this site. Risks are rated high on the basis of the history of the site, its location within the radioactively contaminated soil area associated with SL-1, and the known radioactivity of the contents of the tank and surrounding subsurface soils. Information used to assess the site consists of historical source loading (judged moderately reliable), empirical data obtained during ARA-I shutdown procedures (considered highly reliable), and as-built drawings (considered highly reliable).

III. SUMMARY - CONSEQUENCES OF ERROR:

False Negative Error: If no further action is determined in error for this site, a potential source (in the form of 109 L (28 gal) of radioactive sludge) remains in the tank. This sludge is probably highly radioactive. If the tank loses integrity, this contamination may be released to the environment. However, the tank is enveloped by a concrete vault that will act as secondary containment in the unlikely event of a tank rupture, thus preventing or mitigating spread of contamination to the underlying soil or aquifer. Contaminated subsurface soils also exist at the site. The radioactivity is due in part to long-lived U-235, and may present an eventual threat to groundwater.

False Positive Error: If further remediation is dedicated to this site needlessly, the resources expended, presumably to excavate the tank and collect and analyze samples, would not generate an equitable return in environmental benefits.

Decision Recommendation - continued

IV. SUMMARY - OTHER DECISION DRIVERS:

Tank ARA-729 is scheduled for excavation and sampling decontamination and decommissioning procedures in 1996 (ref 13). The tank area is surrounded by a 7-ft-tall chain-link fence and is a posted radiation hazard located in an inactive facility. Therefore, ARA-16 does not represent an immediate threat to site personnel. As long as integrity of the stainless steel tank is maintained, the tank contents are not available to the environment; all pipes and connections have been removed and capped.

The tank rests in an 8-in.-thick concrete vault. Although the vault has no concrete cover, 3.5 ft of mixed soil and gravel cover the tank and vault. The vault has four sides and a bottom. In the unlikely event of a tank rupture, the concrete vault would provide secondary containment, thus preventing or mitigating spread of contamination to the underlying soil or aquifer.

RECOMMENDED ACTION:

ARA-16 should be deferred to the WAG 5 RI/FS with the understanding that the D&D program will remove the tank prior to the completion of the RI/FS. In this manner, the CERCLA 5-year review will ensure that the potential problem is addressed. The tank, its contents, the associated concrete vault, and surrounding subsurface soils and gravel clearly present a potentially unacceptable risk. However, since the tank is scheduled for removal and sampling in 1996, it is reasonable to delay final assessement until after the tank is exhumed. New soil samples will be collected and analyzed following appropriate procedures. Sample results will be used to generate a reliable risk assessment and to justify a final decision for the site.

SIGNATURES	# PAGES:	DATE:
Prepared By:	DOE WAG Manager:	
Approved By:	Independent Review:	

DECISION STATEMENT (BY DOE RPM)	
DATE RECEIVED:	
DISPOSITION:	
DATE:	# PAGES (DECISION STATEMENT):
NAME:	SIGNATURE:

DECISION STATEMENT (BY EPA RPM)	
DATE RECEIVED:	
DISPOSITION:	
DATE:	# PAGES (DECISION STATEMENT):
NAME:	SIGNATURE:

DECISION STATEMENT (BY IDHW RPM)	
DATE RECEIVED:	
DISPOSITION:	
DATE:	# PAGES (DECISION STATEMENT):
NAME:	SIGNATURE:

PROCESS/WASTE WORKSHEET
SITE ID ARA-16 Radionuclide Tank ARA-729

Col 1 Processes Associated with this Site	Col 2 Waste Description & Handling Procedures	Col 3 Description & Location of any Artifacts/Structures/Disposal Areas Associated with this Waste or Process
Hot cell operations in ARA-626	Mixed radioactive liquid wastes were drained via a hot sewer through 4-in. stainless-steel pipes to ARA-729. Sometimes, effluents contained methanol, acetone, nitric acid, chlorinated/parafine, or mixed acids. The tank was equipped with a high-liquid-level detector. When required, tank contents were pumped into a tank truck and shipped to ICPP.	The following artifacts are associated with both processes: Artifact: Underground storage tank (ARA-729) Location: Behind ARA-I about halfway between the dirt berm and the ARA-I buildings, approximately centered between ARA-626 and ARA-627, and 3.5 ft underground Description: 1,000 gal stainless steel. All pipes and connections have been removed and capped. Artifact: Containment vault Location: 3.5 ft beneath the surface at the tank location Description: 8-in.-thick concrete with the following measurements: 86 X 72 on two ends, 184 X 72 on two sides, and 184 X 86 on the bottom. The vault has no top. The space between the tank and the vault is filled with gravel.
Material Development & Testing in ARA-627	Mixed radioactive metal etching fluids (acids) were drained via a hot sewer through 4-in. stainless-steel pipes to ARA-729. The tank was equipped with a high-level detector. When required, tank contents were pumped into a tank truck and shipped to ICPP.	Artifact: 2-in. vertical angle iron Location: Centered in the tank area, extending from the tank top about 3.5 ft below the surface to about 1 ft above the surface Description: White excavation guide with red-tipped top Artifact: Posted chain link fence Location: Surrounding the tank area Description: 30 X 30 ft chain link enclosure with two 12-ft gates to allow tank truck access. The fence is 7 ft tall and has three strands of barbed wire on top of the fence on three sides. The fourth side, closest to the buildings, has a 3-ft-wide gate for personnel access and is not topped with barbed wire. Radiation hazard signs are posted on all four sides of the fence.

CONTAMINANT WORKSHEET - Metals and sulfate
SITE ID ARA-16 Radionuclide Tank ARA-729
PROCESSES (Col 1) Hot Cell Operations and Materials Research & Testing
WASTE (Col 2) Hot cell liquid wastes and metal etching fluids

Col 4 What known/potential hazardous substances/constituents are associated with this waste or process?	Col 5 Potential sources associated with this hazardous material	Col 6 Known/estimated concentration of hazardous substances/constituents (mg/L)	Col 7 Risk-based concentration[a]	Col 8 Qualitative risk assessment (Hi/Med/Lo)[b]	Col 9 Overall reliability (Hi/Med/Lo)
Arsenic	Tank contents (sludge)	<0.05		High	High
Barium	Tank contents (sludge)	0.03		High	High
Cadmium	Tank contents (sludge)	0.05		High	High
Chromium	Tank contents (sludge)	0.77		High	High
Copper	Tank contents (sludge)	0.59		High	High
Lead	Tank contents (sludge)	0.89		High	High
Mercury	Tank contents (sludge)	0.003		High	High
Nickel	Tank contents (sludge)	0.14		High	High
Selenium	Tank contents (sludge)	<0.12		High	High
Silver	Tank contents (sludge)	<0.03		High	High
Zinc	Tank contents (sludge)	1.93		High	High
Thallium	Tank contents (sludge)	<0.24		High	High
Sulfate	Tank contents (sludge)	140		High	High

a. Risk-based calculations were not performed for this site. Because it has been recommended to delay the decision to remove the tank, these calculations should also be delayed until after the tank has been excavated and new sampling data are available.

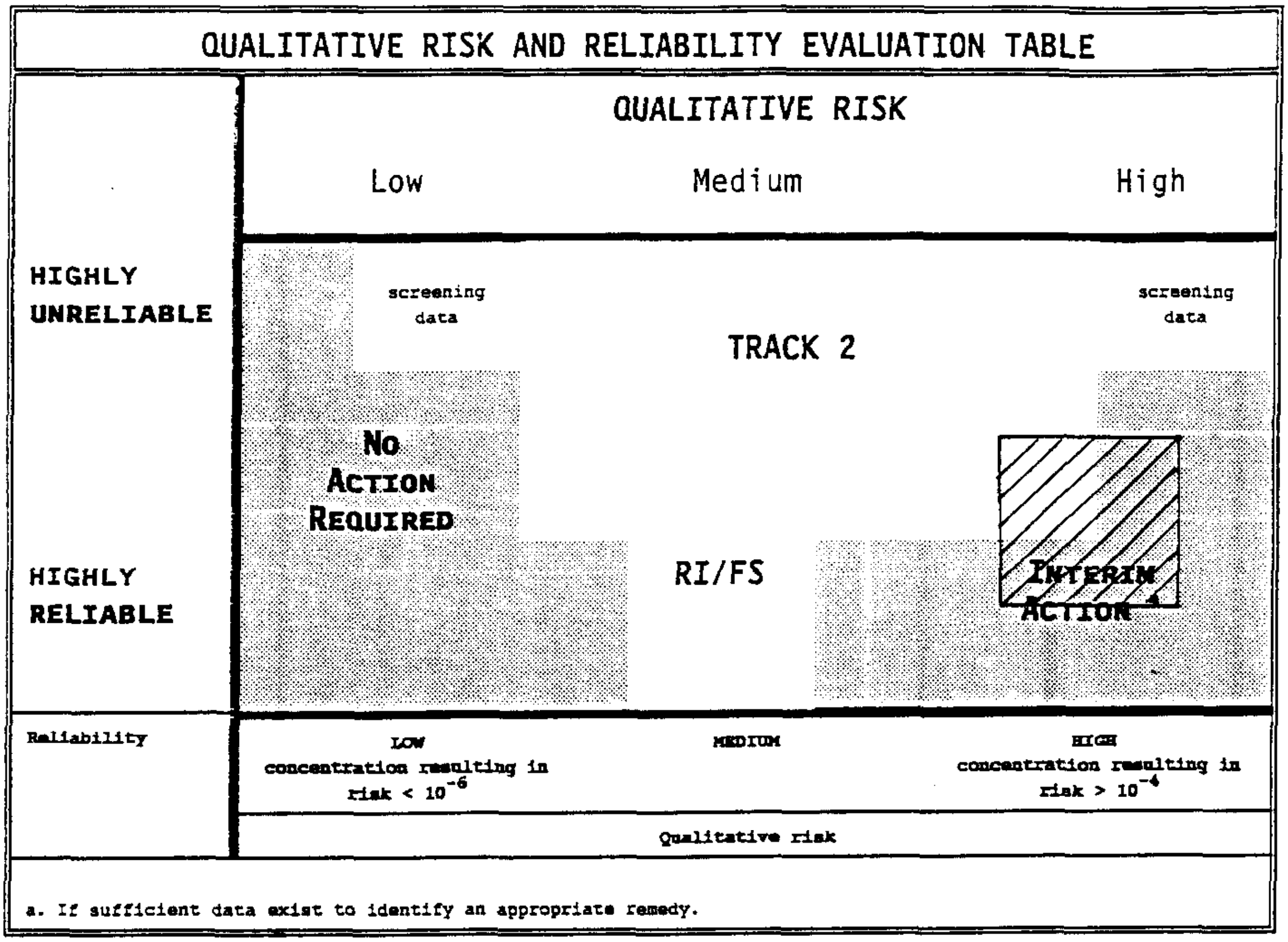
b. Because ARA-16 is known to contain contaminated sludge and because contaminated soils were detected during ARA-I shutdown proceedings, risk has been rated "high," even though risk-based concentrations were not calculated. Risks are rated high on the basis of site history, the location within the radioactively contaminated soil area associated with SL-1, and the known radioactivity of the tank contents and surrounding subsurface soils.

CONTAMINANT WORKSHEET - Volatile organics and radioactivity
SITE ID ARA-16 Radionuclide Tank ARA-729
PROCESSES (Col 1) Hot Cell Operations and Materials Research & Testing
WASTE (Col 2) Hot cell liquid wastes and metal etching fluids

Col 4 What known/potential hazardous substances/constituents are associated with this waste or process?	Col 5 Potential sources associated with this hazardous material	Col 6 Known/estimated concentration of hazardous substances/ constituents	Col 7 Risk-based concentration[a]	Col 8 Qualitative risk assessment (Hi/Med/Lo)[b]	Col 9 Overall reliability (Hi/Med/Lo)
1,1-dichloroethene	Tank contents (sludge)	640 micrograms/L		High	High
1,1-dichloroethane	Tank contents (sludge)	100 micrograms/L		High	High
Trans-1,2-dichloroethene	Tank contents (sludge)	4 micrograms/L		High	High
1,1,1-trichloroethane	Tank contents (sludge)	10300 micrograms/L		High	High
Trichloroethene	Tank contents (sludge)	4800 micrograms/L		High	High
Tetrachloroethene	Tank contents (sludge)	4 micrograms/L		High	High
Toluene	Tank contents (sludge)	230 micrograms/L		High	High
Xylene	Tank contents (sludge)	10 micrograms/L		High	High
Radionuclides (including U-235)	Tank contents (sludge)	20 to 25 mR/hr		High	High
Radionuclides	Contaminated subsurface soils	400 to 1000 dpm beta/gamma		High	High
Radionuclides	Contaminated surface soils	1 mR/hr		High	High

a. Risk-based calculations were not performed for this site. Because it has been recommended to delay the decision to remove the tank, these calculations should also be delayed until after the tank has been excavated and new sampling data are available.

b. Because ARA-16 is known to contain contaminated sludge and because contaminated soils were detected during ARA-I shutdown proceedings, risk has been rated "high," even though risk-based concentrations were not calculated. Risks are rated high on the basis of site history, the location within the radioactively contaminated soil area associated with SL-1, and the known radioactivity of the tank contents and surrounding subsurface soils.



Arsenic	1,1-dichloroethene
Barium	1,1-dichloroethane
Cadmium	Trans-1,2-dichloroethene
Chromium	1,1,1-trichloroethane
Copper	Trichloroethene
Lead	Tetrachloroethene
Mercury	Toluene
Nickel	Xylene
Selenium	Radionuclides (including U-235)
Silver	
Zinc	
Sulfate	

Risks are rated high on the basis of site history, location within the radioactively contaminated soil area associated with SL-1, and the known radioactivity of the tank contents and surrounding subsurface soils.

Question 1. What are the waste generation process locations and dates of operation associated with this site?

Block 1 Answer:

ARA-16 is a 1,000-gal stainless-steel underground storage tank (ARA-729). The tank is located on the north side of ARA-I about halfway between the dirt berm at the ARA-I facility, roughly centered between ARA-626 and ARA-627. The tank was installed in 1959 and was used as a liquid radioactive waste holding tank. When ARA-I was shut down in 1988, the tank was deactivated.

Two processes, as illustrated in Figure 1, contributed wastes to the tank: hot cell operations in building ARA-626 and materials research and testing in building ARA-627. The hot cells were in operation from 1957 to 1988, and materials research was supported from 1970 to 1984.

Block 2 How reliable is/are the information source(s)? X High __Med __Low (check one)

EXPLAIN THE REASONING BEHIND THIS EVALUATION.

Dates of operation, documented in several reports, are reliable. Tank management records and as-built drawings indicate the installation date and tank materials.

Block 3 Has this INFORMATION been confirmed? X Yes __No (check one)

IF SO, DESCRIBE THE CONFIRMATION.

Several reports are in concurrence concerning dates of operation. As-built drawings were drafted about the same time, inferring that these dates are correct.

Block 4 **SOURCES OF INFORMATION** (check appropriate box(es) & source number from reference list)

No available information	[ ]		Analytical data	[ ]	
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[X]	1,2	Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Areal photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[X]	4	D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
Other	[X]	3			

Question 2. What are the disposal process locations and dates of operation associated with this site?

Block 1 Answer:

The hot cells were operated from 1957 to 1988, but the tank was not installed until 1959. Referenced documents do not record how wastes ere disposed prior to the installation of the tank. After the tank was installed, radioactively contaminated waste water was passed through a hot sewer to the holding tank. Up to 100 L per year of contaminated soapy wash water and about 5 L per year each of methanol, acetone, chlorinated/parafine, and mixed acids were flushed to a hot sewer and subsequently to tank ARA-729 via a 4-in. stainless-steel pipe.

Materials research and testing activities were supported in building ARA-627 from 1970 to 1984. About 20 L per year of radioactively contaminated acids associated with routine metal etching activities were routed to the hot sewer and then to ARA-729 via a 4-in. stainless-steel pipe.

The tank had a high-liquid-level alarm. When the alarm triggered, the tank contents were emptied into a tank truck and transported to ICPP for disposal.

The tank area is enclosed by a 30 x 30 ft chain-link fence. The tank itself is a horizontal right-circular cylinder, and rests in a concrete vault, as illustrated in Figure 2. The space between the tank and the vault walls under and around the tank is filled with gravel. The top of the tank is about 3.5 ft below the surface and was originally covered by compacted backfill and a layer of gravel. However, during ARA-I shutdown activities in 1988, the tank was partially uncovered to facilitate sampling and to remove and cap all connections. The tank contents were agitated and removed during shutdown activities. Approximately 109 L (28 gal) of liquid and sludge were left in the tank. The surface soils and gravel used to backfill over the tank when shutdown procedures were complete were probably mixed during the excavation and backfill activities. The only remaining visible artifacts are the posted chain-link fence surrounding the tank area, and a 2-in. angle iron, left as an excavation guide, that projects from the top center of the tank to about 1 ft above the surface.

Block 2 How reliable is/are the information source(s)? __High X Med __Low (check one)

EXPLAIN THE REASONING BEHIND THIS EVALUATION.

Most of the process waste data were not obtained from process records, but taken second hand from a table in the Installation Assessment Report (ref #1, page 161). Information concerning the tank construction is taken from as-built drawings and is probably reliable.

Question 2 - continued

Block 3 Has this INFORMATION been confirmed? X Yes X No (check one)

IF SO, DESCRIBE THE CONFIRMATION.

Process waste information is not confirmed, but the tank configuration was confirmed when the tank was partially uncovered during the 1988 ARA-I shutdown proceedings.

Block 4 **SOURCES OF INFORMATION** (check appropriate box(es) & source number from reference list)

No available information	[ ]	
Anecdotal	[ ]	
Historical process data	[X]	1,2
Current process data	[ ]	
Areal photographs	[X]	11,12
Engineering/site drawings	[X]	9,10
Unusual Occurrence Report	[ ]	
Summary documents	[ ]	
Facility SOPs	[ ]	
Other	[ ]	
Analytical data	[ ]	
Documentation about data	[ ]	
Disposal data	[ ]	
Q.A. data	[ ]	
Safety analysis report	[ ]	
D&D report	[ ]	
Initial assessment	[ ]	
Well data	[ ]	
Construction data	[ ]	

Question 3.	Is there evidence that a source exists at this site? If so, list the sources and describe the evidence.

Block 1 Answer:

Four potential sources exist at this site:

<u>Subsurface contaminated soils:</u> Observations from the ARA-I shutdown proceedings indicate that contamination was found in the subsurface soils alongside the outlet pump line and around the two inlet lines in the manhole cover. These lines are directly over the tank within the imaginary perimeter formed by projecting the vault to the surface. General contamination in the soils around the tank ranged from 400-1000 disintegrations per minute beta/gamma. It is not clear in the reference (see Figure 2) whether or not all contamination is within the perimeter of the vault. However, since some of the soils that were excavated and surveyed were outside the vault boundary, it is likely that contamination is also present outside of the vault perimeter. This contamination would be due to the mixing of backfilled soils.

<u>Contaminated surface soils:</u> A radiological surface survey performed in August 1991 detected 1 mR/hr. It should be noted that ARA-16, located on the north side of ARA-I, is within the general contaminated soils area associated with the 1961-1962 SL-1 accident and cleanup operations. Surface contamination at ARA-16 may be present due to those activities, but may be undiscernable from contamination resulting from overspill associated with tank operations.

<u>Remaining tank contents:</u> The tank still contains about 3 in. (about 109 L) of radioactive liquid and sludge. When the ARA-I facility was shut down in 1988, five samples of the tank contents were collected and analyzed for metals, volatile organics, and sulfate. Constituents and concentrations are listed on the Contaminant Worksheet. The samples were surveyed in the field by Health Physics and averaged 20-25 mR/hr. Field readings taken at the manhole opening were 2R/hr beta/gamma.

<u>Concrete vault:</u> The concrete vault remains in place around the tank. If contaminated, it may also represent a potential source.

Block 2 How reliable is/are the information source(s)? X High __Med __Low (check one)

EXPLAIN THE REASONING BEHIND THIS EVALUATION.

Empirical data indicate the contaminated status of the tank contents and soils surrounding the tank.

Question 3 - continued

Block 3 Has this INFORMATION been confirmed? __Yes X_No (check one)

IF SO, DESCRIBE THE CONFIRMATION.

Laboratory analysis for radionuclides was not performed; therefore, field readings are not confirmed. However, radioactivity was expected since the tank was dedicated to hot wastes. Laboratory results for metals, volatile organics, and sulfate were validated.

Block 4 **SOURCES OF INFORMATION** (check appropriate box(es) & source number from reference list)

No available information	[ ]		Analytical data	[X]	5,6,7,8
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[X]	1	Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Areal photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[X]	4	D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
Other	[X]	2			

Question 4. Is there empirical, circumstantial, or other evidence of migration? If so, what is it?

Block 1 Answer:

There is evidence that contamination exists in the surface and subsurface soils outside of the perimeter of the concrete vault that surrounds the tank. The extent of migration is unknown.

Block 2 How reliable is/are the information source(s)? X High __Med __Low (check one)

EXPLAIN THE REASONING BEHIND THIS EVALUATION.

Empirical data collected in the field indicate the presence of contaminated soils.

Block 3 Has this INFORMATION been confirmed? __Yes X No (check one)

IF SO, DESCRIBE THE CONFIRMATION.

Migration is not confirmed.

Block 4 **SOURCES OF INFORMATION** (check appropriate box(es) & source number from reference list)

No available information	[ ]		Analytical data	[ ]	
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[ ]		Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Areal photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[ ]		D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
Other	[X]	2			

Question 5. Does site operating or disposal historical information allow estimation of the pattern of potential contamination? If the pattern is expected to be a scattering of hot spots, what is the expected minimum size of a significant hot spot?

Block 1 Answer:

From 3.5 ft below the surface down to about 9.5 ft, a concrete vault entirely envelopes all but the top of the tank. Even if the tank leaked, it is probable that contamination would be contained by the vault and the gravel between the vault and the tank. Contamination from surface spills or leakage from inlet pipes outside of the vault may have generated the field survey radiation readings in soils over and around the tank. It is expected that contamination resulting from surface spills associated with emptying the tank would be concentrated around the outlet pump. However, some contamination may exist outside the boundary of the vault due to the mixing of backfilled soils.

Block 2 How reliable is/are the information source(s)? X High __Med __Low (check one)

EXPLAIN THE REASONING BEHIND THIS EVALUATION.

Vault emplacement information is taken from as-built drawings and is probably reliable. Contamination around the outlet pump was detected during field activities.

Block 3 Has this INFORMATION been confirmed? __Yes X No (check one)

IF SO, DESCRIBE THE CONFIRMATION.

The areal extent of contaminant migration has not been confirmed.

Block 4 **SOURCES OF INFORMATION** (check appropriate box(es) & source number from reference list)

No available information	[ ]		Analytical data	[X]	2
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[ ]		Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Areal photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[X]	4	D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
Other	[ ]				

Question 6.	Estimate the length, width, and depth of the contaminated region. What is the known or estimated volume of the source? If this is an estimated volume, explain carefully how the estimate was derived.

Block 1 Answer:

Contaminated surface and subsurface soils and gravel: The inside dimensions of the concrete vault are 64 x 70 x 168 inches. The 1,000-gal tank is a right-circular cylinder lying on its side with a length of 144in. and a radius of 23 in. Potentially contaminated mixed soils and gravel lying within the vault equals the volume of the vault less the volume of the tank:
$(64)(70)(168) - \pi(23)^2(144) = 752640 - 239314 = 513326 \text{ in.}^3 \approx 297 \text{ ft}^3 \approx 11 \text{ yd}^3$.

Depth from the surface to the top of the tank and vault is 3.5 ft. Using the outside dimensions of the vault and the depth to the tank, 6 x 14 x 3.5 ft, calculation yields an estimate of 294 $\text{ft}^3 \approx 11 \text{ yd}^3$ of potentially contaminated mixed soil and gravel directly above the tank. This contamination, if present, may have been generated by overspill associated with tank operations, the SL-1 accident and clean-up activities, or some combination of the two.

Summing the two volumes above yields 11 + 11 = 22 yd^3 of potentially contaminated mixed soil and gravel. This estimate does not consider any contamination that may have been spilled or migrated outside of the imaginary perimeter generated by projecting the dimensions of the concrete vault to the surface. Contamination directly over the tank was detected in soils near the outlet pump housing and the two inlet lines in the manhole cover. General soil contamination was also reported. Since some of the excavated soils were outside of the perimeter of the concrete vault, it is likely some contamination also exists outside of the vault perimeter. Soils were probably mixed during backfilling operations.

The pipelines and pipeline corridors from ARA-626 and ARA-627 were disconnected and capped in 1988, and are not included in the assessment of ARA-16.

Tank contents: About 109 L (ref 7) of liquid sludge still exist in the bottom of the tank.

Concrete vault: The vault is constructed of 8-in.-thick concrete. Outside dimensions are 86 x 72 in. on two ends, 184 x 72 in. on two sides, and 184 x 86 in. on the bottom. These dimensions result in a volume of potentially contaminated concrete of
$8[2(86)(72) + 2(184)(72) + (184)(86)] = 437632 \text{ in.}^3 \approx 253 \text{ ft}^3 \approx 9.4 \text{ yd}^3$.

Question 6 - continued

Block 2 How reliable is/are the information source(s)? __High X_Med __Low (check one)

EXPLAIN THE REASONING BEHIND THIS EVALUATION.

Dimensions of the tank and vault are well documented in as-built drawings. The depth of remaining waste in the tank was measured and source volume was calculated from that measurement. However, the validity of assuming all soils directly above the tank are contaminated or limiting the extent of contamination above the tank to the perimeter of the vault is not substantiated.

Block 3 Has this INFORMATION been confirmed? X_Yes X_No (check one)

IF SO, DESCRIBE THE CONFIRMATION.

The source volume present in the tank was confirmed in 1988, but the volume of potentially contaminated mixed soils and gravel is estimated based on the tank and vault dimensions and is not confirmed.

Block 4 **SOURCES OF INFORMATION** (check appropriate box(es) & source number from reference list)

No available information	[ ]		Analytical data	[ ]	
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[ ]		Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Areal photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[X]	4	D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
Other	[X]	7			

Question 7. What is the known or estimated quantity of hazardous substance/constituent at this source? If the quantity is an estimate, explain carefully how the estimate was derived.

Block 1 Answer:

No soil samples were analyzed, so estimated quantities of constituents in soils cannot be produced. Field analyses during the 1988 shutdown activities detected radioactivity readings from 400 to 1,000 dpm β/γ.

Approximately 109 L of liquid and sludge remain in the bottom of the tank. In an investigation of the potential for a criticality accident in the tank (ref 7), it was determined that as much as 5 g of U-235 may be present.

In 1988, samples of the tank contents were collected and analyzed; two for metals, one for sulfate, and one for volatile organics. Detected concentrations and calculated quantities are given below:

Analyte	Highest Detected Concentration (mg/L)	Calculated Quantity (mg)
Arsenic	<0.05	<5.45
Barium	0.03	3.27
Cadmium	0.05	5.45
Chromium	0.77	83.93
Copper	0.59	64.31
Lead	0.89	97.01
Mercury	0.003	0.327
Nickel	0.14	15.26
Selenium	<0.12	<13.08
Silver	<0.03*	<3.27
Zinc	1.93	210.37
Sulfate	140*	15,260

Analyte	Highest Detected Concentration (µg/L)	Calculated Quantity µg
1,1-dichloroethene	640**	69,760
1,1-dichloroethane	100	10,900
Trans-1,2-dichloroethene	4***	400
1,1,1-trichloroethane	10,300**	1.1E6
Trichloroethene	4,800**	523,200
Tetrachloroethene	4***	400
Toluene	230**	25,070
Xylene	10	1,090

* Quality control results were poor for both of these analytes.

** These values are greater than the calibration range of the instrument and are therefore estimated concentrations.

*** These values are less than the contract required detection limits and are therefore estimatied concentrations.

Block 2 How reliable is/are the information source(s)? X High __Med __Low (check one)

EXPLAIN THE REASONING BEHIND THIS EVALUATION.

The contents of the tank were agitated for an hour and removed before sampling. It is likely that the sample concentrations are representative of the remaining tank contents.

Qestion 7 - Continued

Block 3 Has this INFORMATION been confirmed? X Yes __No (check one)

IF SO, DESCRIBE THE CONFIRMATION.

Laboratory data were validated and results are footnoted in Block 1.

Block 4 **SOURCES OF INFORMATION** (check appropriate box(es) & source number from reference list)

No available information	[ ]		Analytical data	[X]	2,5,6,7
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[ ]		Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Areal photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[ ]		D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
Other	[ ]				

Question 8.	Is there evidence that this hazardous substance/constituent is present at the source as it exists today? If so, describe the evidence.

Block 1 Answer:

Yes. Radioactive contents remain in the bottom of the tank. During ARA-I shutdown procedures, the pump and all external piping was removed from the tank, and all openings were sealed. Unless the contents have leaked, the contents remain today.

Radioactively contaminated mixed soils and gravel are also probable. A surface survey in 1991 indicated the presence of 1 mR/hr directly over the tank. Field surveys conducted during the 1988 shutdown activities also indicated the presence of contaminated soils below the surface at levels ranging from 400 to 100 dpm β/γ. It is known that long-lived U-235 is one of the radionuclides in the tank; therefore, it is likely that subsurface radioactivity is still present.

Block 2 How reliable is/are the information source(s)? X High __Med __Low (check one)

EXPLAIN THE REASONING BEHIND THIS EVALUATION.

Information is based on validated empirical data.

Block 3 Has this INFORMATION been confirmed? __Yes X No (check one)

IF SO, DESCRIBE THE CONFIRMATION.

Block 4 **SOURCES OF INFORMATION** (check appropriate box(es) & source number from reference list)

No available information	[ ]		Analytical data	[X]	5,6,7
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[ ]		Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Areal photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[ ]		D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
Other	[X]	2,7			

REFERENCES

1. EG&G Idaho, Inc., *Installation Assessment Report for EG&G Idaho, Inc., Operations at the Idaho National Engineering Laboratory*, EGG-WM-6875, January 1986.

2. D. C. Sparks, *NMEO Program ARA-I Shutdown Final Report*, approximate date April 1988.

3. INEL Tank Database Form for ARA-729.

4. Engineering drawing, "Contaminated Waste Details," as-built drawing number 961-AREA/SF-301-3, index number 102711.

5. Notegram from Rodney Stockton to D. Sparks, "Inorganic Sample Results," approximate date January 20, 1988.

6. Interoffice Correspondence, P. Pink to D. Sparks, "ARA-I Tank Sample for Volatile Organic Analysis SDG #M1017 - PNP-03-88," January 7, 1988.

7. Interoffice Correspondence, D. W. Knight to J. S. Williams, "Criticality Potential fro ARA-I Waste Storage Tank - SF 729 - DWKn-2-88," May 27, 1988.

8. Radiological Control Survey Form, ARA-16 Radionuclide Tank (ARA-729), August 28, 1991.

9. Engineering drawing, "Waste Tank Emptying System Piping & Electrical Plans," as-built drawing number 842-AREA/SF-729-P&E-1, index number 150051.

10. Engineering drawing, "Waste Tank Emptying System Piping & Electrical Sect.," as-built drawing number 842-AREA/SF-729-P&E-2, index number 150052.

11. Photograph number 91-280-1-6.

12. Photograph number 91-280-1-3.

13. Report of telephone conversation, K.J. Holdren to T. Theil, "Date of ARA-729 Scheduled D&D," March 3, 1993.

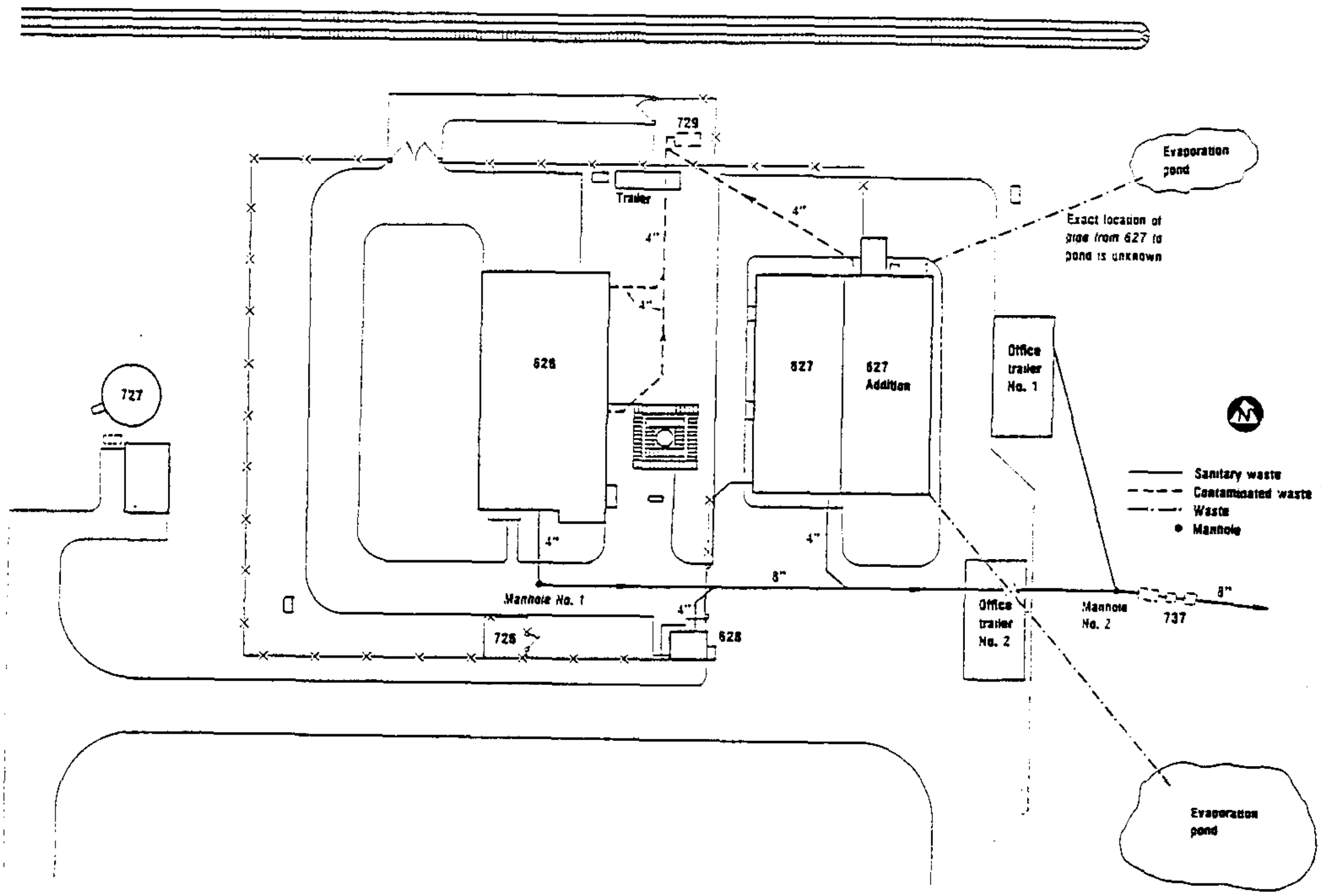
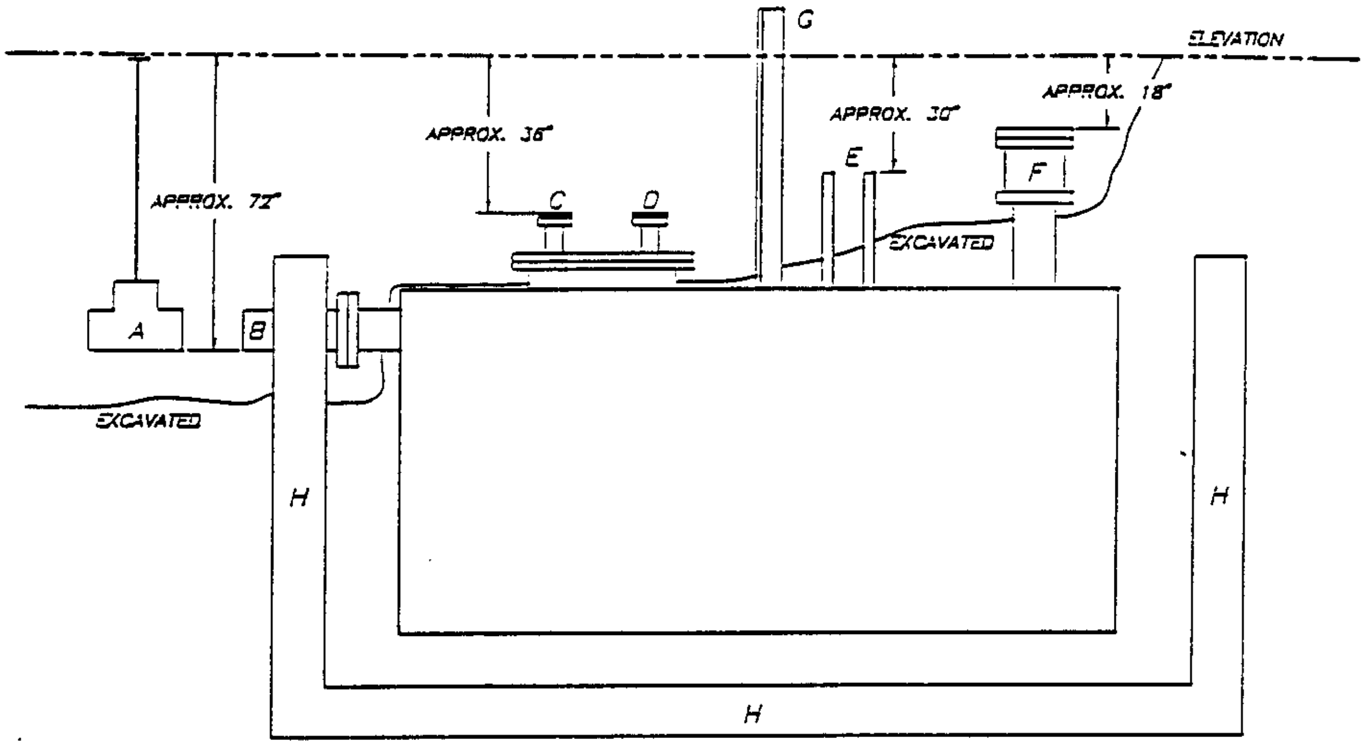


Figure 1. ARA-I waste lines.



A = ISOLATION VALVE, CUT & CAPPED, ≤ 500 mr/hr βγ @ CONTACT, 50 mr/hr βγ @ 2'–0
B = 4" INLET LINE, CUT & CAPPED, ≤ 300 mr/hr βγ @ CONTACT
C = 2" INLET LINE, BLIND FLANGED, 20 mr/hr βγ @ CONTACT (≤ 3,000 c/m βγ w/ 2A IN SOIL)
D = 2" INLET LINE, BLIND FLANGED, 20 mr/hr βγ @ CONTACT
E = 1" INSTR. LINES, CUT & CAPPED, 10 mr/hr βγ @ CONTACT
F = 4" OUTLET PUMP HOUSING, BLIND FLANGED, 30 mr/hr βγ @ CONTACT, ≤ 5,000 c/m βγ w/ 2A IN SOIL
G = 2" ANGLE IRON, LEFT AS EXCAVATION GUIDE
H = CONCRETE VAULT

NOTE: GBF VARIED FROM 5–30 mr/hr βγ @ WAIST LEVEL WITH TANK EXPOSED, 2 R/HR βγ WAS SEEN LEVEL WITH MANHOLE COVER WHEN REMOVED, GENERAL C LEVELS SEEN IN SOIL WERE 400–1000 d/m βγ WITH SMEAR COUNTER EXCEPT FOR AT LOCATION C, D, & F.
CONTACT READINGS A & B MADE w/ RO-3A, ALL OTHER READINGS MADE w/ GM.

Figure 2. ARA-I hot cells hot waste catch tank (ARA-729) 1988 shutdown activities.

4.6.2 ARA Wastes Generated by Specific Activity

Through the investigation of reports on past activities, interviews with past and present personnel assigned to ARA, and through site tours, a list of hazardous waste constituents and approximate quantities has been drawn up for the ARA. This list is presented in Table 4.6.1. Those facilities which are not now, nor have in the past, generated any significant quantities of hazardous waste are omitted from this table. The facilities identified in Table 4.6.1 are discussed in the following paragraphs.

4.6.2.1 ARA-I. The hot cells, ARA 626 (ARA-I), have been in operation since 1957. They were originally used to support operations for the ARMY's Nuclear Reactor Program conducted at ARA. In 1965, all activities in support of the ARMY's program were curtailed at ARA, and activities in the hot cell were dedicated to other programs at the INEL. . In 1970, the operation of the hot cell became dedicated to Fuels and Material research, but this had no significant impact on the quantity or type of work at the hot cell. The hazardous chemicals used at the hot cell were limited to small quantities of solvents and acids.

Typically, because of the personnel hazards associated with these chemicals in a hot cell environment, soap and water were the cleaning agents of choice. When organic solvents were used, either methanol or acetone was used because of their high vapor pressures. Occasionally, nitric acid was used in the hot cell laboratory. The effluents generated during these operations were passed through a hot sewer to a radioactive holding tank. Periodically, this tank was emptied and the contents shipped to ICPP for processing and disposal. Contaminated radiation worker clothing and rags, either contaminated or moistened with cleaning fluids, were originally sent to the RWMC. More recently, these articles, if not contaminated with TRU waste, have been sent to WERF prior to disposal at the RWMC.

ref #1 Installation Assessment Report

Building 627 (ARA-I) was originally a print shop which generated small amounts (approximately 300 lb/yr) of rags which were occasionally wetted with acetone/printing fluids. These rags were disposed of in a land-fill.

During 1970, Building 627 was modified and expanded and subsequently used for materials research and testing. From 1970 to 1984, small amounts of organic solvents and mineral acids were used in operations in Building 627. Typically, but infrequently, when large amounts of acids or solvents were used on a specific project, they were retained and sent to TRA or ICPP for disposal. The small amounts of acids and solvents which were used on a more routine basis (metal etching, cleaning, etc.) were disposed of in the following manner. Acids which were radioactively contaminated (from metal etching operations) were put into the radioactive waste sewer and retained in the radioactive waste tank (the same tank used by Building 626). These wastes were subsequently treated and disposed of
929 at ICPP when the tank was periodically emptied. Nonradioactively contaminated acids and solvents were disposed of in a chemical leach field located south of Building 627.

In 1980, minor modifications were again made to this building to provide space for a radiochemistry laboratory. This laboratory performs extractions to determine potential leaching of radionuclides from waste forms and other inorganic media. By the nature of the work performed, approximately 95 to 99% of the low-level radioactivity contained in the analytical samples is retained on filter paper, and periodically sent to the RWMC. The minor amounts of radioactivity which are not captured during extraction operations (approximately 1×10^{-12} Ci/mL) and the organic solvents used in the extraction process (xylene, heptane, 2-ethyl hexanol, and methanol) are sent to the chemical leach field.

In 1984, the materials research and testing operations were moved from Building 627, and presently the only work being performed in the building is in the radiochemistry laboratory.

"present" = January 1986 ?

TABLE 4.6.1. AUXILIARY REACTOR AREA FACILITIES WASTE GENERATION

Shop Location	Function	Waste Stream	Time Frame	Estimated Quantities (if known)	Treatment/Storage/Disposal
ARA-626 (ARA I)	Hot Cells	Degreasing waste	1957-present		Idaho Chemical Processing Plant (ICPP)
		Mixed radioactive			
		Soap/water		100 l/yr	via [illegible] tank ARA-729
		Acetone		5 l/yr	
		Methanol		5 l/yr	
		Chlorinated/parafine		5 l/yr	
		Metal etching wastes	1957-present		
		Mixed acids		<5 l/yr	ICPP
		Rags/Radiation clothing	1957-present	300 lb/yr	RWMC & WERF
ARA-627 (ARA I)	Print Shop	Rags/cleaning	1957-1970	300 lb/yr	Landfill
		Acetone/printing fluids		20 lb/yr	Landfill
	Materials Development & Testing	Metal etching fluids			
		Mixed radioactive (HNO_3)	1970-1984	20 l/yr	ICPP
		Non-radioactive (HNO_3)	1976-1984	20 l/yr	Chemical Leach Field
		Solvents			
		Acetone, Methanol	1970-1984	20 l/yr	Chemical Leach Field
	Radiochemistry Lab	Lightly contaminated solvents (~1 x 10^{-12} Ci/ml) Xylene, Heptane, 2-ethyl hexanol, Methanol	1980-present	12 l/yr (total)	Chemical Leach Field